

Impact of Atmospheric Infrared Sounder (AIRS) Thermodynamic Profiles on Regional Weather Forecasting

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In data sparse regions, remotely-sensed observations can be used to improve analyses and lead to better forecasts. One such source comes from the Atmospheric Infrared Sounder (AIRS), which together with the Advanced Microwave Sounding Unit (AMSU), provides temperature and moisture profiles with accuracy comparable to that of radionsondes. The purpose of this paper is to describe a procedure to assimilate AIRS thermodynamic profile data into a regional configuration of the Advanced Research Weather Research and Forecasting (WRF-ARW) model using its three-dimension variational (3DVAR) analysis component (WRF-Var). Quality indicators are used to select only the highest quality temperature and moisture profiles for assimilation in both clear and partly cloudy regions. Separate error characteristics for land and water profiles are also used in the assimilation process. Assimilation results indicate that AIRS profiles produce an analysis closer to *in situ* observations than the background field. Forecasts from a 37-day case study period in the winter of 2007 show that AIRS profile data can lead to improvements in 6-h cumulative precipitation forecasts due to instability added in the forecast soundings by the AIRS profiles. Additionally, in a convective heavy rainfall event from February 2007, assimilation of AIRS profiles produces a more unstable boundary layer resulting in enhanced updrafts in the model. These updrafts produce a squall line and precipitation totals that more closely reflect ground-based observations than a no AIRS control forecast. The location of available high-quality AIRS profiles ahead of approaching storm systems is found to be of paramount importance to the amount of impact the observations will have on the resulting forecasts.

17th Conference on Satellite Meteorology and Oceanography, 27 Sept - 1 Oct, 2010, Annapolis, MD